

parent insect in the pupal condition, but his argument does not amount to much; and it may well be borne in mind that an example of somewhat analogous character is afforded by the alternative characters exhibited by the leaves and other structures of many amphibious plants. Many of these can assume one of two different forms, the production of either depending on the stimulus given by the environment to the embryonic tissues at the growing points. Thus the form of, say, a leaf of such a plant is determined at a very early stage in its development, and long before it is sufficiently advanced for any functionally direct adaptation to a terrestrial or to an aquatic environment. But when once the stimulus has operated, subsequent removal to opposite conditions does not result in a corresponding alteration in the future development of such a leaf—it belongs definitely to the aquatic or to the terrestrial type, whichever line of ontogeny it embarked on from the first. It would seem, at any rate for the present, and in the absence of sufficient experimental evidence to the contrary, more natural to regard these di- or polymorphic species as "balanced" forms; the actual course of their ontogeny, whilst restricted to certain directions, and confined within definite limits, depending on the alternative character of some metabolic activity. This is, however, very different from an admission of the "inheritance of acquired characters." For if anything at all is meant by the expression, it can only imply that the hereditary mechanism has itself undergone a definite and corresponding change; and at present a direct influence of the environment in this sense is negatived by the results of the most critically conducted experiments on breeding.

Hertwig takes up a definite position as to the relation of the "somatic" to the "germ" cells. He regards all the cells of the body as fundamentally equivalent, though differentiation may mask and finally render impossible the return of a particular cell to the embryonic state. The definite tissue cell has become specialised rather as the result of an impulse from without than by a segregative process of analysis; and herein he is diametrically opposed to Weismann and his followers, in regarding cellular differentiation as a secondary rather than as a primary matter. In this he will find many who are at one with him, for the "erbungleich" division postulated by Weismann, which would result in development consisting of a sorting out or analysis of the characters of the germ, conflicts with many facts of experience, and it is only by numerous "Hilfshypothese" that it can be sustained for the plant and vegetable kingdoms.

In a notice of a book like this one of Hertwig's, it is natural that the points on which diversity of opinion prevails should occupy a relatively prominent place. But such treatment is in no way intended to detract from or to minimise the great value of the work, coming as it does from one who has himself done so much to advance the subject of which he writes, and whose lucid and suggestive treatment of his theme will always command attention. It is a book that should be read by all who are interested in the questions of modern biology.

J. B. FARMER.

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#### APPRECIATIONS OF HAECKEL.

- (1) *Ernst Haeckel: Der Mann und sein Werk.* By Carl W. Neumann. Pp. 80. (Berlin: Gose and Tetzlaff, n.d.) Price 1.50 marks.
- (2) *Haeckel: His Life and Work.* By Wilhelm Bölsche, with introduction and supplementary chapter by the translator, Joseph McCabe. Pp. 336; illustrated. (London: T. Fisher Unwin, 1906.) Price 15s. net.
- (3) *Last Words on Evolution: a Popular Retrospect and Summary.* By Ernst Haeckel. Translated from the second edition by Joseph McCabe. Pp. 127; with portrait and three plates. (London: A. Owen and Co., 1906.) Price 6s.

(1) **M**ANY who know Prof. Haeckel only as the author of zoological memoirs, evolutionist essays, and monistic propaganda, will be glad of the opportunity which this brightly written booklet affords of becoming more closely acquainted with the man himself and with the story of his life. We read with interest of the eager boy-naturalist wandering on the Siebengebirge, of the apprenticeship under Johannes Müller, of the year of medical practice (if a man can practise on three patients!), of the eventful year in Italy during which Haeckel nearly became a landscape painter, of the growing fascination which the plankton exerted, satisfying, at once his artistic and scientific interests, of the influence that the "Origin of Species" had on him, and of his early settlement in Jena—that "feste Burg freien Denkens"—which nothing could ever induce him to leave. At the Stettin Versammlung in 1863 Haeckel entered the lists as a champion of the evolutionist "Weltanschauung," contending almost single-handed against contempt and prejudice. His cause, which eventually prevailed, as the truth must, had to be fought for, and those who are offended by the impetuous expressions of Haeckel's "Sturmernatur" are profitably reminded by this little book of the courage and indefatigability of perhaps the most virile protagonist of a thesis which has been one of the greatest contributions made by science to human progress. The author has told the story of Haeckel's life and work with vividness and enthusiasm. He concludes his effective sketch by indicating, somewhat too tersely and vaguely, how it has been possible for him to use the truth that is in Haeckel in developing a monistic philosophy more satisfying to the human spirit.

(2) Prof. W. Bölsche's study of Ernst Haeckel is, like the frontispiece to the book, a picture in warm colours. The author is nothing if not enthusiastic, and indeed no one can think over the achievements of Haeckel's life without sharing the author's admiration for his hero. If it be true, as the translator says, that "a hundred Haeckels, grotesque in their unlikeness to each other, circulate in our midst to-day," this "plain study of his personality and the growth of his ideas" should go far to replace them by giving us an appreciation approximately true. We should not ourselves have called Bölsche's book, as Mr. McCabe does, a "plain study," for its characteristic features are exuberant enthusiasm and a brilliantly

picturesque style which sometimes startles the reader with its daring.

We cannot do more than refer to a few of the interesting facts regarding Haeckel to which the author gives prominence. "Haeckel's genealogical tree spreads into the legal profession in a curiously complex way." This inheritance was expressed in Haeckel's imperious craving for clear lines and systematic arrangement, and in his fondness for formulating "laws." Apart from the influence of his teachers, such as Johannes Müller and Virchow, and of his friends, such as Gegenbaur, it was the sea—at Helgoland, at Nice, at Messina—that really won Haeckel for zoology. Regarding his pupillary period, the curious fact is mentioned that one of the theses he defended when taking his doctorate at Berlin was the impossibility of spontaneous generation. In 1860 Haeckel was "profoundly moved" by a first reading of "The Origin of Species," and conversations with Gegenbaur finally confirmed his conviction of the truth of Darwinism—a conviction which found its first, though not prominent, expression in his monograph on Radiolaria (1862). In 1863, at the Stettin congress, when Haeckel made his first open confession of the faith that was now in him, he won a laurel crown at the Leipzig athletic festival for the long jump (20 feet), and the translator justly remarks that we have here "the note of much in his character." What many zoologists, who neither misunderstand Haeckel nor fail to do him homage, feel, is that the impetuous, daring, pioneering evolutionist of Jena has taken many long jumps which scientific caution makes them refuse.

A fine chapter of the book is devoted to what is perhaps Haeckel's best and most lasting work, the "Generelle Morphologie" (1866). It was written, partly as a relief from sorrow, in less than a year, during which the author lived the life of a hermit, sleeping barely three or four hours a day, with habits so ascetic that he wondered at his survival. But the great work was too difficult for the general reader, too philosophical for the biologists, too biological for the philosophers, and thus with a clearly defined mission Haeckel set himself to the task, which he has so successfully accomplished, of making monistic evolutionism "understood of the people."

One of the many interesting incidents related in Bölsche's appreciation may be quoted.

"A stern theologian presented himself in person at the chateau of Karl Alexander, Grand Duke of Weimar, and begged him to put an end to this scandal of the professorship of Haeckel, the arch-heretic. The Grand Duke, educated in the Weimar tradition of Goethe, asked, 'Do you think he really believes these things that he publishes?' 'Most certainly he does,' was the prompt reply. 'Very good,' said the Grand Duke, 'then the man simply does the same as you do.'"

As Prof. Bölsche closed his charming biographical sketch in 1900, the translator, who has done his work admirably, has added a chapter on the crowning years, dealing with the controversies over the "Riddle of the Universe," and other events. The whole work, helped by the excellent portraits, leaves one with a grateful impression of a remarkable personality who has all his life been a good fighter yet most lovable withal,

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who has done much for pure science and yet has never ceased to say "Das Leben ist schön."

(3) In these three lectures, delivered last year in Berlin, Prof. Haeckel reiterated with wonted frankness and fearlessness his evolutionist and monistic convictions. He trounced the theologians and metaphysicians for ignoring or combating or misrepresenting the secure results of science, and he did not refrain from reprobating some of his own craft—even his revered master, Virchow—for trying to sit on both sides of the fence. He is himself so well satisfied with the naturalistic formulation of what goes on, and has gone on, in the wide world, that he has no patience with those who seek for explanations that science *ex hypothesi* can never give.

The law of evolution and the law of substance (the conservation of matter and energy) "are irreconcilable with the three central dogmas of metaphysics, which so many educated people still regard as the most precious treasures of their spiritual life—the belief in a personal God, the personal immortality of the soul and the liberty of the human will." Not that these are to be driven out of the world. "They merely cease to pose as truths in the realm of pure science. As imaginative creations, they retain a certain value in the world of poetry."

To many this will seem a false antithesis, an opposition of incommensurables. It can hardly be pathologically that the human spirit has so persistently attempted to get beyond common sense and empirical science to a formulation of the efficient causes, the significance, the purpose of all becoming. As a matter of fact, Haeckel himself is a worshipper of "a Monistic god, the all-embracing essence of the world, the Nature-god of Spinoza and Goethe, identical with the eternal, all-inspiring energy, one, in eternal and infinite substance, with space-filling matter," whose "will is at work in every falling drop of rain and every growing crystal, in the scent of the rose and in the spirit of man."

The lectures have been very successfully translated by Mr. McCabe. We may note that the date given for Weismann's theory of germ-plasm is 1844, which seems rather early, while that of Lamarck's "Philosophie Zoologique" (1899) is rather late.

#### PRACTICAL GEOGRAPHY.

*An Introduction to Practical Geography.* By A. T. Simmons and Hugh Richardson. Pp. xi+380. (London: Macmillan and Co., Ltd., 1905.) Price 3s. 6d.

THIS book is based on an excellent idea, which has in many ways been excellently carried out. Its design is to show how to cultivate in the teaching of geography the methods of scientific training, the methods by which boys and girls are guided to reach sound conclusions from their own observations and experiments.

Unfortunately, the execution of this design is marred by the apparent absence from the minds of the authors of a clear idea of what geography is. Geography, it must be admitted, is a subject which